AMENDMENTS TO THE CLAIMS

1. (Previously presented) A charged particle beam alignment method which performs an axis alignment for a lens and uses a charged particle beam apparatus having a lens for converging a charged particle beam emitted from a charged particle source and forming a sample image by detecting secondary charged particles emitted from a sample by radiating the charged particle beam onto the sample converged by the lens, the method comprising the steps of:

changing a convergence condition of an objective lens to two states when a deflection condition of an alignment deflector is rendered to a first state;

detecting a first two dimensional deviation between first and second sample images obtained when the deflection condition of said alignment deflector is rendered to the first state;

changing the convergence condition of said objective lens to at least two states when the deflection condition of said alignment deflector is rendered to a second state;

detecting a second two dimensional deviation between third and fourth sample images obtained when the deflection condition of said alignment deflector is rendered to the second state;

calculating an unknown changing depending on a condition of said charged particle beam optical apparatus by applying information of the first and second two dimensional deviations to an equation indicating the relation of an alignment condition and deviation of the sample images; and

obtaining the alignment condition based on the calculated unknown and a condition in which an image deviation becomes small when the convergence condition of the objective lens varies.

2. (Previously presented) A charged particle beam alignment method which performs an axis alignment for an astigmatism corrector by an alignment deflector and uses a charged particle beam apparatus having an astigmatism corrector for performing an astigmatism correction of the charged particle beam emitted from a charged particle source and forming a sample image by detecting secondary charged particles emitted from a sample by radiating said charged particle beam corrected by said astigmatism corrector onto the sample, the method comprising the steps of:

changing a correction condition of said astigmatism corrector to two states when a deflection condition of said alignment deflector is rendered to a first state;

detecting a first two dimensional deviation between first and second sample images obtained when the deflection condition of said alignment deflector is rendered to the first state;

changing the correction condition of said astigmatism corrector to at least two states when the deflection condition of said alignment deflector is rendered to a second state;

detecting a second two dimensional deviation between third and fourth sample images obtained when the deflection condition of said alignment deflector is rendered to the second state;

calculating an unknown changing depending on a condition of said charged particle beam by applying information of the first and second two dimensional

deviations to an equation indicating the relation of an alignment condition and deviation of the sample images; and

obtaining the alignment condition based on the calculated unknown and a condition in which an image deviation becomes small when the correction condition of the astigmatism corrector is changed to the two condition.

3. (Canceled)

4. (Previously presented) A charged particle beam apparatus which forms a sample image based on an output of a detector and has a charged particle source, a lens for converging a charged particle beam emitted from the charged particle source, an alignment deflector for performing an axis alignment of the said charged particle beam for the convergence lens, and the detector for detecting secondary charged particles emitted from a sample by radiating said charged particle beam thereonto, the charged particle beam apparatus comprising:

a memory for memorizing first and second sample images obtained by changing a convergence condition of said lens to two states when a deflection condition of said alignment deflector is rendered to a first state and for memorizing third and fourth sample images obtained by changing the convergence condition of said lens to two states when the deflection condition of said alignment deflector is changed to a second condition; and

a control device for calculating a coefficient indicating the two dimensional deviation between said images with respect to a signal supplied to said alignment deflector based on said first and second two dimensional deviations, wherein the signal to be supplied to the alignment deflector is calculated using said coefficient such that the deviation between said images becomes zero or nearly zero.

5. (Original) The charged particle beam apparatus according to claim 4, wherein said control device calculates said aligner condition based on a condition in which the deviation between sample images obtained by changing the condition of said convergence lens to the two states.

6. (Original) The charged particle beam apparatus according to claim 4, wherein said control device controls said lens and said alignment deflector so that said first and third sample images are obtained by rendering said alignment deflector from the first state to the second state in a state where said lens is rendered to a certain convergence condition and then said second and fourth sample images are obtained in a state where said lens is rendered to other convergence conditions.

7. (Original) The charged particle beam apparatus according to claim 4, wherein said control device acquires at least said four sample images and then restores the deflection condition of the alignment deflector to an optical condition when said first sample image is acquired, thus calculating a drift amount based on the deviation between both sample images.

8. (Previously presented) A charged particle beam apparatus which forms a sample image based on an output of a detector and has a charged particle source, an astigmatism corrector for performing an astigmatism correction of a charged particle beam emitted from the charged particle source, an alignment deflector for performing an axis alignment of the said charged particle beam for said astigmatism corrector, and the detector for detecting secondary charged particles emitted from a sample by radiating said charged particle beam thereonto, the charged particle beam apparatus comprising:

a memory for memorizing first and second sample images obtained by changing a correction condition of said astigmatism corrector when a deflection

condition of said alignment deflector is rendered to a first state and for memorizing third and fourth sample images obtained by changing the correction condition of said astigmatism corrector to two states when the deflection condition of said alignment deflector is changed to a second condition; and

a control device for calculating a coefficient indicating the two dimensional deviation between said images with respect to a signal supplied to said alignment deflector based on said first and second two dimensional deviations, wherein the signal to be supplied to the alignment deflector is calculated using said coefficient such that the deviation between said images becomes zero or nearly zero.

9. (Original) The charged particle beam apparatus according to claim 8, wherein said control device calculates said aligner condition based on a condition in which the deviation between sample images obtained by changing the condition of said convergence lens to the two states.

10. (Original) The charged particle beam apparatus according to claim 8, wherein said control device acquires at least said four sample images and then restores the deflection condition of the alignment deflector to an optical condition when said first sample image is acquired, thus calculating a drift amount based

on the deviation between both sample images.

11-14. (Canceled)

15. (Previously presented) A charged particle beam alignment method which performs an axis alignment of a charged particle beam for an optical device by an alignment deflector and uses a charged particle beam apparatus having an optical device for changing the charged particle beam emitted from a charged particle source and forming a sample image by detecting secondary charged particles emitted from a

sample by radiating said charged particle beam onto the sample, which is changed by the optical device, the method comprising the steps of:

changing said optical device to at least two states when a deflection condition of said alignment deflector is rendered to a first state;

detecting a first two dimensional deviation between first and second sample images obtained when the deflection condition of said alignment condition is rendered to the first state;

changing the optical device to at least two conditions when the deflection condition of said alignment deflector is rendered to a second state;

detecting a second two dimensional deviation between third and fourth sample images obtained when the deflection condition of said alignment deflector is rendered to the second state; and

calculating a coefficient indicating the deviation between said images with respect to the signal supplied to said alignment deflector based on said first two dimensional deviation and said second two dimensional deviation, wherein an operation condition of the alignment deflector is determined using said coefficient such that the deviation between said images becomes zero or nearly zero.

16. (Previously presented) A charged particle beam apparatus comprising:

a charged particle source;

an optical element for adjusting a charged particle beam emitted by said charged particle source; and

an alignment deflector for axis adjustment with respect to said optical element,

said apparatus further comprising selection means for selecting based on a given indicator whether a coefficient indicating the sensitivity of the alignment deflector should be recalculated, or the operation condition of said alignment deflector should be determined using a coefficient that is stored in advance.

17. (Original) The charged particle beam apparatus according to claim 16, wherein said calculation means calculates the deflection amount of said alignment deflector based on a movement amount between a plurality of images obtained when a condition of said optical device is changed.

18. (Original) The charged particle beam apparatus according to claim 16, wherein said calculation means calculates the deflection amount of said alignment deflector based on a movement amount between a plurality of images, and the number of the images provided for a calculation changes depending on a selection of the calculation method by said selection means.

19. (Original) The charged particle beam apparatus according to claim 16,

wherein said calculation means computes a predetermined variable based on a movement amount between a plurality of images obtained when a condition of said optical device is changed and calculates a change amount of said alignment deflector based on the predetermined variable, and

wherein the number of the images provided for a calculation changes depending on a selection of the calculation method by said selection means.

20-21. (Canceled)

22. (Original) A charged particle beam apparatus which has a charged particle source; an astigmatism corrector for performing an astigmatism correction of a charged particle beam emitted from said charged particle source; an objective lens disposed between said astigmatism corrector and a sample onto which said charged particle beam is radiated, the objective lens converging said charged particle beam; a first alignment deflector for aligning an optical axis of said charged particle beam with said astigmatism corrector; and a second alignment corrector for aligning the optical axis of said charged particle beam with said objective lens, the charged particle beam apparatus comprising:

control means for performing a focus adjustment by use of said objective lens, for performing an axis alignment by use of said first alignment deflector, for performing an axis alignment by use of said second alignment deflector, and for performing an astigmatism correction by use of said astigmatism corrector.

23. (Previously presented) The charged particle beam apparatus according to claim 31, the apparatus further comprising:

calculation means for calculating a deflection amount of the alignment deflector based on a movement amount between a plurality of images obtained when a condition of said optical device is changed, wherein

the plurality of images obtained when the condition of said optical device is changed are displayed.

24. (Previously presented) A charged particle beam apparatus method for a charged particle beam apparatus having an optical element for varying a charged particle beam emitted by a charged particle source, and an alignment deflector for aligning the axis of the charged particle beam with respect to the optical element, wherein the apparatus forms a sample image by detecting secondary charged particles

that are emitted by the sample as the sample is irradiated with the charged particle beam, the method comprising:

calculating a two dimensional deviation between images formed when a condition of said optical element is varied; and

calculating an axial adjustment condition for said alignment deflector that would make smaller said two dimensional deviation, the method further comprising:

calculating a coefficient indicating a relationship between a signal supplied to said alignment deflector and the two dimensional deviation between said images; and

calculating, based on said coefficient, a signal supplied to said alignment deflector such that the deviation between said images becomes zero or nearly zero.

25. (Previously presented) The charged particle beam apparatus according to claim 31, the apparatus further comprising:

means for emitting an alarm when the deviation between the images, which results when the optical element condition is varied, exceeds a predetermined range, or when there is no structural information on the images that is necessary for the detection of an image deviation.

26. (Previously presented) The charged particle beam apparatus according to claim 31, the apparatus further comprising:

means for calculating an alignment condition of the alignment deflector based on information obtained from the sample image;

means for quantizing the sample image; and

means for emitting an alarm when a quantized value obtained by the quantization means is equal to or below a predetermined value.

27. (Previously presented) The charged particle beam apparatus according to claim 31, the apparatus further comprising:

means for measuring the width of an object on the sample based on a line profile obtained by scanning the sample with the charged particle beam either one or two dimensionally; and

means for registering at least one of the sample image, the line profile and the optical condition of the charged particle beam, when the deviation between the images, which results when the optical element condition is varied, exceeds a predetermined range, or when there is no structural information on the images that is necessary for the detection of an image deviation.

28. (Previously presented) The charged particle beam apparatus according to claim 31, the apparatus further comprising:

means for measuring the width of an object on the sample based on a line profile obtained by scanning the sample with the charged particle beam either one or two dimensionally;

means for calculating an alignment condition of the alignment deflector based on information obtained from the sample image;

means for quantifying the sample image; and

means for registering at least one of the sample image, the line profile and the optical condition of the charged particle beam, when the deviation between the images,

which results when the optical element condition is varied, exceeds a predetermined range, or when there is no structural information on the images that is necessary for the detection of an image deviation.

29. (Previously presented) The charged particle beam apparatus according to claim 31, the apparatus further comprising:

means for forming an image based on secondary charged particles obtained by scanning a sample with the charged particle beam; and

means for calculating a deflection amount of the alignment deflector based on information about the image,

wherein the processing by the calculating means is repeated when the amount of deflection calculated by the calculating means is equal to or more than a predetermined value.

30. (Previously presented) The charged particle beam apparatus according to claim 31, the apparatus further comprising:

means for detecting centers of gravity in the patterns of two images obtained when the charged particle beam scans while changing a condition of the optical element; and

means for calculating a deflection amount of the alignment deflector based on a deviation between the centers of gravity of the two patterns.

31. (Currently amended) A charged particle beam apparatus comprising:

a charged particle source;

an optical element for adjusting a charged particle beam emitted by the charged particle source;

an alignment deflector for aligning the axis of the charged particle beam with respect to the optical element;

a detector for detecting charged particles emitted by a sample as the sample is irradiated with the charged particle beam; and

a control device for calculating a two dimensional deviation between images obtained when ~~a condition of~~ said optical element is varied,

wherein said control device calculates ~~a signal supplied to said alignment deflector and~~ a coefficient indicating a variation in the deviation between said images, and calculates a signal to said alignment deflector using said coefficient such that the deviation between said images becomes zero or nearly zero.